

1. PUBLIC HEALTH STATEMENT

This Statement was prepared to give you information about chlorodibromomethane and bromoform (tribromomethane) and to emphasize the human health effects that may result from exposure to these chemicals. These two chemicals are considered together in this report because they are similar in their properties and in the health effects which they cause, and because they are often found together in the environment. The Environmental Protection Agency (EPA) has identified 1,177 sites on its National Priorities List (NPL). Chlorodibromomethane and bromoform have been found at 14 of these sites. However, we do not know how many of the 1,177 NPL sites have been evaluated for chlorodibromomethane and bromoform. As EPA evaluates more sites, the number of sites at which chlorodibromomethane and bromoform are found may change. The information is important for you because chlorodibromomethane and bromoform may cause harmful health effects and because these sites are potential or actual sources of human exposure to chlorodibromomethane and bromoform.

When a chemical is released from a large area, such as an industrial plant, or from a container, such as a drum or bottle, it enters the environment as a chemical emission. This emission, which is also called a release, does not always lead to exposure. You can be exposed to a chemical only when you come into contact with the chemical. You may be exposed to it in the environment by breathing, eating, or drinking substances containing the chemical or from skin contact with it.

If you are exposed to a hazardous substance such as chlorodibromomethane and bromoform, several factors will determine whether harmful health effects will occur and what the type and severity of those health effects will be. These factors include the dose (how much), the duration (how long), the route or pathway by which you are exposed (breathing, eating, drinking, or skin contact), the other chemicals to which you are exposed, and your individual characteristics such as age, sex, nutritional status, family traits, life style, and state of health.

1.1 WHAT ARE CHLORODIBROMOMETHANE AND BROMOFORM?

Chlorodibromomethane and bromoform (also known as tribromomethane) are colorless, heavy, nonburnable liquids with a sweetish odor. In the past, bromoform was used by industry to dissolve dirt and grease and to make other chemicals, and it was also used in the early part of this century as a medicine to help children with whooping cough get to sleep. Currently, bromoform is only produced in small amounts for use in laboratories and in geological and electronics testing. Chlorodibromomethane was used in the past to make other chemicals such as fire extinguisher fluids, spray can propellants, refrigerator fluid, and pesticides.

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Currently it is produced only in small amounts for use in laboratories.

Another source of chlorodibromomethane and bromoform is drinking water. When chlorine is added to drinking water to kill any diseasecausing organisms which might be present, the chlorine reacts with natural substances found in the water, producing low levels of chlorodibromomethane and bromoform as undesired byproducts. Small amounts are also produced by plants in the ocean.

In the environment, chlorodibromomethane and bromoform are not found as pure liquids, but rather they are found either dissolved in water or evaporated into air as a gas. Both chlorodibromomethane and bromoform are relatively stable in the air, but reactions with other chemicals in the air cause them to break down slowly (about 50% in one or two months). Any chlorodibromomethane or bromoform in water or soil may also be broken down by bacteria, but the speed of this process is not known.

Further information on the properties, uses, and behavior of chlorodibromomethane and bromoform in the environment may be found in Chapters 3, 4, and 5.

1.2 HOW MIGHT I BE EXPOSED TO CHLORODIBROMOMETHANE OR BROMOFORM?

You are most likely to be exposed to chlorodibromomethane and bromoform by drinking water that has been treated with chlorine. Usually the levels in chlorinated drinking water are between 1 and 10 parts of chlorodibromomethane and bromoform per billion parts of water (ppb). Chlorodibromomethane and bromoform have also been detected in chlorinated swimming pools. When you are at a pool, you could be exposed by breathing chlorodibromomethane or bromoform that have evaporated into the air, or by uptake from the water through the skin. Neither chlorodibromomethane nor bromoform are likely to be found in food.

If you live near a factory or laboratory that makes or uses chlorodibromomethane or bromoform, you might be exposed to chlorodibromomethane or bromoform in the air. However, since neither chlorodibromomethane nor bromoform have widespread use in this country, they are usually present in outside air at very low levels (less than 0.01 ppb). Therefore, this sort of exposure is not likely for most people. Another place where you might be exposed is near a chemical waste site where chlorodibromomethane or bromoform has been allowed to leak into water or soil. In this case, you could be exposed if you drank the water or got the soil on your skin. Further information on how you might be exposed to these chemicals is given in Chapter 5.

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1.3 HOW CAN CHLORODIBROMOMETHANE AND BROMOFORM ENTER AND LEAVE MY BODY?

Studies in animals and humans indicate that both chlorodibromomethane and bromoform can readily enter your body after you drink them in water or breathe them in air. It is likely that these chemicals would also enter your body if you got them on your skin, but this has not been studied. The main way that chlorodibromomethane and bromoform are removed from the body is by being breathed out through the lungs. Elimination is fairly rapid and complete (from 50% to 90% in 8 hours), so they do not tend to build up in the body. Further information on how chlorodibromomethane and bromoform enter and leave your body is given in Chapter 2.

1.4 HOW CAN CHLORODIBROMOMETHANE AND BROMOFORM AFFECT MY HEALTH?

The effects of chlorodibromomethane and bromoform on your health depend on how much you take into your body. In general, the more you take in, the greater the chance that an effect will occur. Studies in animals and humans indicate that the main effect of eating or breathing large amounts of these chemicals is a slowing down of normal brain activities. This occurs quite quickly, and tends to go away within a day. In humans exposed to large amounts of bromoform, the usual effect is only sleepiness. However, unconsciousness or death can occur in extreme cases. Studies in animals indicate that exposure to high doses of bromoform or chlorodibromomethane may also lead to injury to the liver and the kidneys within a short period of time. Studies in animals also suggest that neither chlorodibromomethane nor bromoform has a high risk of harming an unborn baby, but this has not been studied in humans.

Exposure to low levels of chlorodibromomethane or bromoform do not appear to seriously affect the brain, liver, or kidneys, but studies in animals indicate that long-term intake of either chlorodibromomethane or bromoform can cause cancer. Although no cases of cancer in humans can be definitely attributed to these chemicals, this is an effect of special concern, since many people are exposed to low levels of chlorodibromomethane and bromoform in chlorinated drinking water.

Further information on how chlorodibromomethane and bromoform can affect the health of humans and animals is presented in Chapter 2.

1.5 WHAT LEVELS OF EXPOSURE HAVE RESULTED IN HARMFUL HEALTH EFFECTS?

In general, chlorodibromomethane and bromoform tend to produce similar effects at comparable dose levels, although chlorodibromomethane may be slightly more potent. Tables 1-1 to 1-4 summarize information on the lowest doses that have been shown to cause observable changes. The levels of chlorodibromomethane or bromoform in air that affect humans

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TABLE 1-1. Human Health Effects from Breathing
Chlorodibromomethane or Bromoform*

Short-term Exposure (less than or equal to 14 days)		
<u>Levels in Air</u>	<u>Length of Exposure</u>	<u>Description of Effects</u>
		The health effects resulting from short-term exposure of humans to air containing specific levels of chlorodibromomethane or bromoform are not known.
Long-term Exposure (greater than 14 days)		
<u>Levels in Air</u>	<u>Length of Exposure</u>	<u>Description of Effects</u>
		The health effects resulting from long-term exposure of humans to air containing specific levels of chlorodibromomethane or bromoform are not known.

*See Section 1.2 for discussion of exposures encountered in daily life.

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TABLE 1-2. Animal Health Effects from Breathing
Chlorodibromomethane or Bromoform

Short-term Exposure (less than or equal to 14 days)		
<u>Levels in Air (ppb)</u> 240,000	<u>Length of Exposure</u> 10 days	<u>Description of Effects*</u> Injury to the liver and kidney in rats exposed to bromoform. The health effects resulting from short-term exposure of animals to air containing specific levels of chlorodibromomethane are not known.
Long-term Exposure (greater than 14 days)		
<u>Levels in Air (ppb)</u> 24,000	<u>Length of Exposure</u> 2 months	<u>Description of Effects*</u> Injury to the liver and kidney in rats exposed to bromoform. The health effects resulting from long-term exposure of animals to air containing specific levels of chlorodibromomethane are not known.

*These effects are listed at the lowest level at which they were first observed. They may also be seen at higher levels.

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TABLE 1-3. Human Health Effects from Eating or Drinking Chlorodibromomethane or Bromoform*

Short-term Exposure (less than or equal to 14 days)		
<u>Levels in Food</u>	<u>Length of Exposure</u>	<u>Description of Effects**</u>
		The health effects resulting from short-term exposure of humans to food containing specific levels of chlorodibromomethane or bromoform are not known.
<u>Levels in Water (ppb)</u>		
1,300		Estimated Minimal Risk Level for chlorodibromomethane (based on studies in animals; see Section 1.5 for discussion).
21,000		Estimated Minimal Risk Level for bromoform (see Section 1.5 for discussion).
2,100,000	1 day	Sleepiness in children given bromoform.
Long-term Exposure (greater than 14 days)		
<u>Levels in Food</u>	<u>Length of Exposure</u>	<u>Description of Effects**</u>
		The health effects resulting from long-term exposure of humans to food containing specific levels of chlorodibromomethane or bromoform are not known.
<u>Levels in Water (ppb)</u>		
1,000		Estimated Minimal Risk Level for chlorodibromomethane (based on studies in animals; see Section 1.5 for discussion)
6,900		Estimated Minimal Risk Level for bromoform (based on studies in animals; see Section 1.5 for discussion).

*See Section 1.2 for a discussion of exposures encountered in daily life.

**These effects are listed at the lowest level at which they were first observed. They may also be seen at higher levels.

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TABLE 1-4. Animal Health Effects from Eating or Drinking Chlorodibromomethane or Bromoform

Short-term Exposure (less than or equal to 14 days)		
<u>Levels in Food</u>	<u>Length of Exposure</u>	<u>Description of Effects*</u>
The health effects resulting from short-term exposure of animals to food containing specific levels of chlorodibromomethane or bromoform are not known.		
<u>Levels in Water (ppb)</u>		
190,000	14 days	Mild effects on liver and kidney in mice given chlorodibromomethane.
660,000	14 days	Mild liver injury in mice given bromoform.
2,600,000	14 days	Death in mice given chlorodibromomethane.
2,900,000	14 days	Death in rats given bromoform.
Long-term Exposure (greater than 14 days)		
<u>Levels in Food (ppb)</u>	<u>Length of Exposure</u>	<u>Description of Effects*</u>
880,000	2 yr	Liver injury in rats given chlorodibromomethane.
1,600,000	2 yr	Liver injury in rats given bromoform.
<u>Levels in Water (ppb)</u>		
290,000	2 yr	Mild liver and kidney injury in rats given chlorodibromomethane.
530,000	2 yr	Mild liver and kidney injury in mice given bromoform.
1,300,000	13 wk	Mild liver and kidney injury in mice given chlorodibromomethane.

*These effects are listed at the lowest level at which they were first observed. They may also be seen at higher levels.

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are not known (Table 1-1), but levels of around 1,000 to 2,000 ppb in air can be detected by smell. Levels of 24,000 ppb or higher of bromoform in air have been found to cause liver or kidney injury in animals (Table 1-2), but the levels of chlorodibromomethane in air that affect animals are not known. Swallowing one or two drops of bromoform causes sleepiness in children. This is about equal to the amount of bromoform that would be swallowed in one day from drinking water containing 2,100,000 ppb of bromoform (Table 1-3).

The amount of chlorodibromomethane taken by mouth that would affect humans is not known, but is probably about the same as for bromoform. Studies in animals indicate that concentrations of around 190,000 ppb of chlorodibromomethane or 660,000 ppb of bromoform in food or water can lead to effects on liver or kidneys over a 2-week period (Table 1-4). The amounts of chlorodibromomethane or bromoform that would cause similar effects following skin contact are not known.

Minimal Risk Levels (MRLs) are also included in Table 1-3. These MRLs were derived from animal and human data for both short-term and long-term exposure, as described in Chapter 2 and in Tables 2-2 and 2-3. The MRLs provide a basis for comparison with levels that people might encounter either in the air or in food or drinking water. If a person is exposed to chlorodibromomethane or bromoform at an amount below the corresponding MRL, it is not expected that harmful (noncancer) health effects will occur. Because these levels are based only on information currently available, some uncertainty is always associated with them. Also, because the method for deriving MRLs does not use any information about cancer, an MRL does not imply anything about the presence, absence, or level of risk for cancer.

1.6 IS THERE A MEDICAL TEST TO DETERMINE WHETHER I HAVE BEEN EXPOSED TO CHLORODIBROMOMETHANE OR BROMOFORM?

If you are exposed to chlorodibromomethane or bromoform, measurable levels of the chemicals can sometimes be detected in samples of your blood, breath, or fat. However, there is not enough information at present to use the results of such tests to estimate the level of exposure or to predict the nature or the severity of any health effects that might result. Since special equipment is needed, these tests are not routinely performed in doctors' offices. Because chlorodibromomethane and bromoform are eliminated from the body fairly quickly, these methods are best suited to detecting recent exposures (within 1 or 2 days). Further information on how chlorodibromomethane and bromoform can be measured in exposed humans is presented in Chapters 2 and 6.

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1.7 WHAT RECOMMENDATIONS HAS THE FEDERAL GOVERNMENT MADE TO PROTECT HUMAN HEALTH?

The U.S. Environmental Protection Agency (EPA) has set a Maximum Contaminant Level of 0.10 ppm (parts per million) for the combination of chlorodibromomethane, bromoform, and a group of similar compounds (trihalomethanes) in drinking water. As noted in Section 1.2, most water samples in the United States have levels of chlorodibromomethane and bromoform lower than this. The Food and Drug Administration (FDA) has set the same limit for bottled water, but no rules have been set for chlorodibromomethane and bromoform in food. In order to protect workers from bromoform while on the job, the Occupational Safety and Health Administration (OSHA) states that workers may not be exposed to concentrations of bromoform in air greater than 0.5 ppm for an 8-hour workday. There is no OSHA standard for chlorodibromomethane. Further information on regulations concerning chlorodibromomethane and bromoform are presented in Chapter 7.

1.8 WHERE CAN I GET MORE INFORMATION?

If you have any more questions or concerns not covered here, please contact your State Health or Environmental Department or:

Agency for Toxic Substances and Disease Registry
Division of Toxicology
1600 Clifton Road, E-29
Atlanta, Georgia 30333

This agency can also give you information on the location of the nearest occupational and environmental health clinics. Such clinics specialize in recognizing, evaluating, and treating illnesses that result from exposure to hazardous substances.

